

# CONFIGURING PHYSICAL CHANNEL RESOURCES FOR SOUNDING OR DISCOVERY IN A HALF DUPLEX COMMUNICATION ENVIRONMENT

## FIELD

**[0001]** The present invention relates to wireless communication, and particularly to half-duplex wireless device-to-device communication.

## BACKGROUND

**[0002]** The following description of background art may include insights, discoveries, understandings or disclosures, or associations together with disclosures not known to the relevant art prior to the present invention but provided by the invention. Some such contributions of the invention may be specifically pointed out below, whereas other such contributions of the invention will be apparent from their context.

**[0003]** In recent years, the phenomenal growth of mobile Internet services and proliferation of smart phones and tablets has increased a demand for mobile broadband services, and hence more network capacity is required. One possibility to increase network capacity and to provide new proximity based services to end users and/or different service providers is to deploy in addition to wide area systems local area systems providing device-to-device (D2D) communications. The device-to-device communication may be scheduled in a distributed manner or in a centralized (network assisted) manner. Regardless of the scheduling manner, channel state information (CSI) between devices is needed for scheduling, or at least to find out whether or not the devices are close enough for direct communication. Since the device-to-device communication may be implemented as a half-duplex communication, in which a device may either transmit or receive over a spectrum, receiving and sending phases of sounding signals, for example, needs to be coordinated.

## SUMMARY

**[0004]** A general aspect of the invention provides configuration mechanism for physical channel resources for sounding or discovery in a half-duplex communication environment for apparatuses belonging to a service group. Various aspects of the invention comprise a method, an apparatus, a computer program product and a system as defined in the independent claims. Further embodiments of the invention are disclosed in the dependent claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0005]** In the following, the invention will be described in greater detail by means of preferred embodiments with reference to the attached drawings, in which

**[0006]** FIG. 1 shows simplified architecture of a system and block diagrams of some apparatuses according to an exemplary embodiment;

**[0007]** FIGS. 2, 3 and 4 are flow charts illustrating exemplary functionalities;

**[0008]** FIGS. 5, 6 and 7 illustrate intermediate results in an exemplary dimensioning;

**[0009]** FIGS. 8A, 8B and 8C illustrate an exemplary configuration of the physical channel;

**[0010]** FIG. 9 illustrates another exemplary configuration of the physical channel; and

**[0011]** FIG. 10 is a schematic block diagram of an exemplary apparatus.

## DETAILED DESCRIPTION OF SOME EMBODIMENTS

**[0012]** The following embodiments are exemplary. Although the specification may refer to “an”, “one”, or “some” embodiment(s) in several locations, this does not necessarily mean that each such reference is to the same embodiment(s), or that the feature only applies to a single embodiment. Single features of different embodiments may also be combined to provide other embodiments.

**[0013]** The present invention is applicable to any access network/system and apparatus that support scheduled device-to-device communication over half-duplex communication links. Examples of such access systems/networks include LTE (Long Term Evolution) access system, World-wide Interoperability for Microwave Access (WiMAX), Wireless Local Area Network (WLAN), LTE Advanced (LTE-A), and beyond LTE-A, such as 5G (fifth generation). The specifications of different systems and networks, especially in wireless communication, develop rapidly. Such development may require extra changes to an embodiment. Therefore, all words and expressions should be interpreted broadly and they are intended to illustrate, not to restrict, the embodiment.

**[0014]** Device-to-device communication scheduling may be a centralized scheduling, also called a network assisted scheduling, or a distributed scheduling. In principle, in a centralized scheduling, one node is responsible for scheduling of a service group, whereas in a distributed scheduling nodes belonging to a service group are configured to perform the scheduling. Below different exemplary embodiments and examples are described using the centralized scheduling, without limiting the examples and the invention to such a scheduling manner.

**[0015]** A general architecture of an exemplary local area system 100 is illustrated in FIG. 1. FIG. 1 is a simplified system architecture only showing some elements and functional entities, all being logical units whose implementation may differ from what is shown. It is apparent to a person skilled in the art that the system may also comprise other functions and structures that are not illustrated, for example connections to the core network/system.

**[0016]** The exemplary local area system 100 illustrated in FIG. 1 comprises user equipments 110, 110', 110" and access points 120 (only one illustrated in FIG. 1) providing conventional connections 101, 101', 101" between the user equipments 110, 110', 110" and the access point 120 in both directions, and in addition to that direct communications 102, 102', 102" between the user equipments (also called nodes), and correspondingly communications (not illustrated in FIG. 1) between access points. In the illustrated example of FIG. 1, the user equipments can communicate directly with each other since they are assumed to be in close enough proximity. Should the distance between user equipments be too long, the communication between them would be relayed via the access point or via another user equipment.

**[0017]** In the exemplary local area system 100 the user equipments 110, 110', 110" are connected to a network (not illustrated in FIG. 1) via the access point, and the user equipments have been organized into at least one service group which share a physical channel (i.e. physical